APPARATUS AND METHOD FOR DISTRIBUTING PORTIONS OF LARGE WEB IMAGES TO FIT SMALLER CONSTRAINED VIEWING AREAS

FIELD OF THE INVENTION

The present invention is directed generally towards an apparatus and method for displaying web pages on hand held display devices and specifically towards an apparatus and method for displaying a fragment of an image at the image's intended resolution.

BACKGROUND OF THE INVENTION

Web pages existing on the Internet are well known in the art. Users view web pages using a web browser such as Microsoft's Internet Explorer® or Netscape's Navigator®. The architects of web pages are generally referred to as web page designers. The web page designers layout web page elements, such as images, text, and hyperlinks, in an orderly fashion so that the user may quickly obtain useful information from the web page. The size of an image on a web page is generally referred to as the image resolution. Web page designers layout the image and set the image resolution for display on desktop or notebook computer screens.

Wireless telephones and personal digital assistants (PDAs) with web browsing capabilities are also well known in the art. These devices are generally known as hand held display devices (HHDDs). One of the problems encountered with browsing the Internet with a HHDD web browser is that the display screen on a HHDD is much smaller than the display screen on a desktop or notebook computer. In order to display a whole web page on the smaller screen, the HHDDs generally shrink or reduce the web page down to a smaller resolution. Thus, the user sees a smaller version of the entire web page. However, reducing the size of the web page is problematic because the web page elements may become too small to read or understand.

Therefore, a need exists in the art for a method of displaying web page elements at their intended resolution on an HHDD display screen.

The prior art has previously addressed the problem of viewing reduced web pages. For example, United States Patent 6,300,947 (the '947 patent) entitled "Display Screen and Window Size Related Web Page Adaptation System" discloses a method of adapting web pages to fit onto smaller screens. The method of the '947 patent involves breaking elements of the webpage apart and separately displaying the elements on different screens. However, the method disclosed in the '947 patent is not preferable because the user is not able to view an image at the intended resolution.

United States Patent Application Publication 2002/0158908 (the '908 application) entitled "Web Browser User Interface for Low-Resolution Displays" also discloses a method of adapting web pages to fit onto smaller screens. The method of the '908 application displays the web page at the web page's full resolution, but only displays a portion of the web page on the HHDD display screen. The method of the '908 application is not preferable because the user is only able to view a portion of the webpage and is required to view all elements of the webpage at full resolution.

Consequently, a need exists in the art for an improved apparatus and method of viewing a web page on a HHDD. The need extends to an apparatus and method which allows the user to view the entire web page and simultaneously view images at the image's intended resolution. Moreover, the need extends to a method which allows the user to navigate images such that the user may view the entire image at the image's intended resolution, albeit in separate, distinct sections.

SUMMARY OF THE INVENTION

The present invention, which meets the needs stated above, is a methodology for displaying a website on a hand held display device (HHDD), such as a wireless telephone or personal digital assistant (PDA). The software embodiment of the present invention comprises an Image Modification Program (IMP) and a Navigation Program (NP). The IMP analyzes the webpage HTML to determine if an image is present and, if so, if the image exceeds the allotted image display space on the HHDD display screen. If the image does exceed the allotted space on the display screen, the IMP calculates the required number of x-axis and y-axis divisions and fragments the image accordingly. The present invention displays the reduced web page on the HHDD, but replaces the reduced image with a fragment from the fragmented image. The fragment is displayed at the resolution intended by the web page designer. Thus the present invention differs from the prior art in that the user views the web page with a portion of the image at full size, as opposed to the whole image at a reduced size. The NP of the present invention allows the user to move from one fragment to another.

Alternatively, the software embodiment of the present invention may comprise a Proxy Modification Program (PMP) and a Proxy Navigation Program (PNP). The PMP and PNP work similarly to the IMP and NP, but utilize a proxy to decrease the amount of information that must be transmitted to the HHDD. Specifically, the PMP fragments the image and only sends a single fragment along with the reduced web page to the HHDD. If desired, the user may request other fragments using the PNP.

BRIEF DESCRIPTION OF THE DRAWINGS

The novel features believed characteristic of the invention are set forth in the appended claims. The invention itself, however, as well as a preferred mode of use, further objectives and advantages thereof, will best be understood by reference to the following detailed description of an illustrative embodiment when read in conjunction with the accompanying drawings, wherein:

FIG. 1 is an illustration of a computer network used to implement the present invention;

FIG. 2 is an illustration of a hand-held display device (HHDD) used to implement the present invention;

FIG. 3 is an illustration of a communications system used to implement the present invention;

FIG. 4 is an illustration of the memory used to implement the present invention;

FIG. 5 is an illustration of the logic of the Image Modification Program (IMP) of the present invention;

FIG. 6 is an illustration of the logic of the Navigation Program (NP) of the present invention;

FIG. 7 is an illustration of the logic of the Proxy Modification Program (PMP) of the present invention;

FIG. 8 is an illustration of the logic of the Proxy Navigation Program (PNP) of the present invention;

FIG. 9 is an example of an image downloadable over the Internet which may be altered by the present invention;

FIG. 10 is an example of the fragmented image produced by the present invention; and

FIG. 11 is an example of a web browser displaying an image produced by the present invention.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

As used herein the term "computer" shall mean a machine having a processor, a memory, and an operating system, capable of interaction with a user or other computer, and shall include without limitation desktop computers, notebook computers, personal digital assistants (PDAs), servers, handheld computers, and similar devices.

As used herein, the term "display screen" means a device used to display a graphical user interface of a computer program. Examples of display screens are liquid crystal display (LCD) screens, plasma screen, cathode ray tubes, computer monitors, thin film transistor (TFT) screens, and the like. Persons of ordinary skill in the art are aware of other types of display screens.

As used herein, the term "HHDD" is an acronym for "hand held display device" and means any portable device capable of displaying an image. Examples of HHDDs are wireless telephones, personal digital assistants (PDAs), handheld computers, digital cameras, and similar devices.

As used herein, the term "image" means any graphical depiction of an object or scene. Images are typically stored in computer files ending with a .jpg, .bmp, or .gif file name suffix. Persons of ordinary skill in the art are aware of other types of image files.

As used herein, the term "resolution" means the size of an image or screen. Resolution is measured in pixels in both the x-axis and the y-axis.

FIG. 1 is an illustration of computer network **80** associated with the present invention. Computer network **80** comprises local machine **85** electrically coupled to network **86**. Local

machine **85** is electrically coupled to remote machine **84** and remote machine **83** via network **86**. Local machine **85** is also electrically coupled to server **81** and database **82** via network **86**. Network **86** may be a simplified network connection such as a local area network (LAN) or may be a larger network such as a wide area network (WAN) or the Internet. Furthermore, computer network **80** depicted in FIG. 1 is intended as a representation of a possible operating network that may contain the present invention and is not meant as an architectural limitation.

FIG. 2 is an illustration of a communications network used to implement the present invention. Local machine **85**, connected to network **86** may also be connected to transmitter/receiver **88**. Transmitter/receiver **88** is capable of wireless communication with a plurality of devices, including hand held display device (HHDD) **90**. HHDD **90** is capable of two-way communication with computer network **80**, which may be the Internet, through transmitter/receiver **88** and local machine **85**.

FIG. 3 is an illustration of HHDD **90**. HHDD **90** comprises display screen **92** and navigation buttons **94**. When HHDD **90** is used to access the Internet, the user may view web pages on display screen **92** and enter data through a plurality of navigation buttons **94**.

The internal configuration of a computer, including connection and orientation of the processor, memory, and input/output devices, is well known in the art. The present invention is a methodology that can be embodied in a computer program. Referring to FIG. 4, the methodology of the present invention is implemented on software by Image Modification Program (IMPP) **200**. IMP **200** includes Navigation Program (NP) **300**, Proxy Modification Program (PMP) **400**, and Proxy Navigation Program (PNP) **500**. IMP **200**, NP **300**, PMP **400**, and PNP **500** described herein can be stored within the memory of any computer depicted in FIG. 1 or HHDD **90** depicted in FIGS. 2 and 3. Alternatively, IMP **200**, NP **300**, PMP **400**, and

PNP **500** can be stored in an external storage device such as a removable disk, a CD-ROM, or a USB storage device. Memory **100** is illustrative of the memory within one of the computers of FIGS. 1, 2 or 3. Memory **100** also contains web browser **102** and display screen data **104**. The present invention may interface with web browser **102** and/or display screen data **104** through memory **100**. As part of the present invention, the memory **100** can be configured with IMP **200**, NP **300**, PMP **400**, and/or PNP **500**. Processor 106 can execute the instructions contained in IMP **200**, NP **300**, PMP **400**, and/or PNP **500**.

In alternative embodiments, IMP **200**, NP **300**, PMP **400**, and/or PNP **500** can be stored in the memory of other computers. Storing IMP **200**, NP **300**, PMP **400**, and/or PNP **500** in the memory of other computers allows the processor workload to be distributed across a plurality of processors instead of a single processor. Further configurations of IMP **200**, NP **300**, PMP **400**, and/or PNP **500** across various memories are known by persons of ordinary skill in the art.

Turning to FIG. 5, the logic of Image Modification Program (IMP) **200** is illustrated. IMP **200** is a program that fragments images displayed on a HHDD and displays a portion of the original image at its intended resolution. IMP **200** starts (**202**) whenever the user opens a web browser application. Web browsers are well known in the art and examples of web browsers include Microsoft's Internet Explorer® and Netscape's Navigator®. When using a web browser, the user enters a desired web page uniform resource locator (URL) and IMP **200** follows the web browser to the desired web page (**204**). IMP **200** then analyzes the web page's hyper text markup language (HTML) and determines if the web page contains an image (**206**). For purposes of determining if an image is present, IMP **200** searches for files containing a .bmp, .jpg, or .gif file ending. Persons of ordinary skill in the art will be aware of other file endings for image files. If the web page does not contain any images, then IMP **200** displays the web page

without modification (**210**) and ends (**224**). If at step **206** IMP **200** determines that the web page contains an image, then IMP **200** proceeds to step **208**.

At step **208** IMP **200** determines if the image size is greater than the area on the display screen size of the HHDD which is allocated to display the image (**208**). IMP **200** can determine the size of the display screen from the display screen data **104** illustrated in FIG. 4. The area of the display screen which is allocated to display the image will depend on the layout of the web page and can be obtained from the web page HTML. IMP **200** can access the image size from the image data in the web page HTML. The image size is the intended resolution of the image. In comparing the image size to the display screen size, IMP **200** will determine that the image is larger than the display screen if either: the x-axis dimension of the image is larger than the x-axis dimension of the allocated space on the display screen, or the y-axis dimension of the image is larger than the y-axis dimension of the allocated space on the display screen. Because the HHDD displays the entire web page, the image size will almost always be larger than the allocated screen display area. In some embodiments, the area on the display screen allocated to display the image may be the entire display screen on the HHDD. If IMP **200** determines that the image size is not less than the allocated display screen size, then IMP **200** displays the web page without modification (**210**) and ends (**224**). If IMP **200** determines that the image size is larger than the allocated display screen size, then IMP **200** proceeds to step **212**.

At step **212**, IMP **200** calculates the number of x-axis divisions (**212**). The number of x-axis divisions is equal to the image x-axis dimension divided by the allocated screen x-axis dimension, rounded up to the nearest whole number. Rounding up ensures that the image will be displayed at the intended resolution. For example, if an image has an x-axis dimension of 600 pixels and the allocated screen x-axis dimension is 200 pixels, then there are three x-axis

divisions ($\frac{600\ pixels}{200\ pixels} = 3\ divisions$). If the quotient obtained in calculating the x-axis divisions contains a remainder, then the last x-axis division will contain part of the original image displayed at the intended resolution.

At step **214**, IMP **200** calculates the number of y-axis divisions **(214)**. The number of y-axis divisions is equal to the image y-axis dimension divided by the allocated screen y-axis dimension, rounded up to the nearest whole number. Rounding up ensures that the image will be displayed at the intended resolution. For example, if an image has a y-axis dimension of 405 pixels and the allocated screen y-axis dimension is 135 pixels, then there are three y-axis divisions ($\frac{405\ pixels}{135\ pixels} = 3\ divisions$). If the quotient obtained in calculating the y-axis divisions contains a remainder, then the last y-axis division will contain part of the original image displayed at the intended resolution.

Next, IMP **200** divides the image into fragments **(216)**. The number of fragments is equal to the number of x-axis divisions multiplied by the number of y-axis divisions. When fragmenting the image, IMP **200** repeatedly breaks-up the image into fragments along the x-axis at the allocated screen x-axis dimension. For example, if the image is 600 pixels wide along the x-axis and the allocated screen x-axis dimension is 200 pixels, then IMP **200** will break up the image at the 200th pixel and the 400th pixel, producing a total of three fragments along the x-axis. Similarly, IMP **200** repeatedly breaks-up the image into fragments along the y-axis at the allocated screen y-axis dimension. For example, if the image is 405 pixels wide along the y-axis and the allocated screen y-axis dimension is 135 pixels, then IMP **200** will break up the image at the 135th pixel and the 270th pixel, producing a total of three fragments along the y-axis. Thus, the total image is broken into nine distinct fragments. An example of a fragmented image can be

seen in FIG. 10. IMP **200** stores the fragmented image in cache memory under a distinct file name.

IMP **200** then displays the web page with the first fragment replacing the original image (**218**). In displaying the web page, IMP **200** displays the entire web page in the reduced resolution similar to the prior art method of displaying a web page on a smaller screen. However, the present invention differs from the prior art in that IMP **200** replaces the original image with a fragment of the original image. The image fragment is displayed at the image resolution intended by the web page designer. When displaying the image fragment, IMP **200** can first display the center fragment or any other fragment as determined by persons of ordinary skill in the art.

IMP **200** then determines if the user wants to navigate the image (**220**). If the user wants to navigate the image, then IMP **200** runs NP **300** (**222**) and returns to step **220**. If the user does not want to navigate the image, IMP **200** ends (**224**).

Turning to FIG. 6, the logic of Navigation Program (NP) **300** is illustrated. NP **300** is a program that navigates the image fragmented by IMP **200**. NP **300** starts (**302**) when prompted by IMP **200**. NP **300** then makes a determination whether the user has pressed an up button (**304**). If the user has pressed the up button, NP **300** displays the fragment directly above the present fragment (**306**) and proceeds to step **308**. If the user has not pressed the up button, then NP **300** proceeds to step **308** where NP **300** makes a determination whether the user has pressed the down button (**308**). If the user has pressed the down button, NP **300** displays the fragment directly below the present fragment (**310**) and proceeds to step **312**. If the user has not pressed the down button, then NP **300** proceeds to step **312** where NP **300** makes a determination whether the user has pressed the left button (**312**). If the user has pressed the left button, NP **300**

displays the fragment directly to the left of the present fragment (**314**) and proceeds to step **316**. If the user has not pressed the left button, then NP **300** proceeds to step **316** where NP **300** makes a determination whether the user has pressed the right button (**316**). If the user has pressed the right button, NP **300** displays the fragment directly to the right of the present fragment (**318**) and ends (**320**). If the user has not pressed the right button, then NP **300** ends (**320**).

Persons of ordinary skill in the art are aware of other methods of indicating a desire to navigate a fragmented image other than pressing buttons. Persons of ordinary skill in the art will also appreciate that a fragmented image may be wrapped top-to-bottom such that a user can reach the top row of a fragmented image by pressing down from the bottom row and vice-versa. Similarly, persons of ordinary skill in the art will also appreciate that a fragmented image may be wrapped left-to-right such that a user can reach the left row of a fragmented image by pressing right from the right row and vice-versa.

Turning to FIG. 7, the logic of Proxy Modification Program (PMP) **400** is illustrated. PMP **400** is a program that fragments images displayed on a HHDD and displays a portion of the original image at its intended resolution, similar to PMP **200**, but with the use of a proxy. PMP **400** operates on a proxy and automatically fragments the image for the HHDD. PMP **400** starts (**402**) whenever the user opens a web browser application. PMP **400** follows the web browser to the desired web page (**404**). PMP **400** accesses the web page (**406**) and analyzes the web page's HTML and determines if the web page contains an image (**408**). For purposes of determining if an image is present, PMP **400** searches for files containing a .bmp, .jpg, or .gif file ending. Persons of ordinary skill in the art will be aware of other file endings for image files. If the web page does not contain any images, then PMP **400** displays the web page without modification

(**412**) and ends (**428**). If at step **408** PMP **400** determines that the web page contains an image, then PMP **400** proceeds to step **410**.

At step **410** PMP **400** determines if the image size is greater than the area on the display screen size of the HHDD which is allocated to display the image (**410**). PMP **400** analyzes the display screen size and image size similarly to IMP **200**. If PMP **400** determines that the image size is not less than the allocated display screen size, then PMP **400** displays the web page without modification (**412**) and ends (**428**). If PMP **400** determines that the image size is larger than the allocated display screen size, then PMP **400** proceeds to step **414** where PMP **400** calculates the number of x-axis divisions (**414**). PMP **400** calculates the number of x-axis divisions similarly to IMP **200**. PMP **400** then calculates the number of y-axis divisions (**416**). PMP **400** calculates the number of y-axis divisions similarly to IMP **200**.

Next, PMP **400** divides the image into fragments (**418**). PMP **400** divides the image into fragments similarly to IMP **200**. PMP **400** then sends the web page with the first fragment to the HHDD (**420**). PMP **400** stores the fragmented image on the proxy so that only a portion of the original image is transmitted to the HHDD. The HHDD may then display the web page with the fragmented image similarly to IMP **200**. An example of a portion of the HTML code used execute step **420** is:

```
<FORM METHOD="POST" ACTION="bitmap.pl">
<IMP SRC="../tmp/image.jpg" WIDTH=99 HEIGHT=72 BORDER=1>
<INPUT TYPE="HIDDEN" NAME="url" VALUE=http://initialimage.jpg>
<INPUT TYPE="HIDDEN" NAME="program" VALUE="Unique_Identifier">
<INPUT TYPE="HIDDEN" NAME="state" VALUE="5">
<INPUT TPYE="IMAGE" SRC = "../icons/small/arrow-left.jpg" NAME="L"
VALUE="L">
<INPUT TPYE="IMAGE" SRC = "../icons/small/arrow-right.jpg" NAME="R"
VALUE="R">
<INPUT TPYE="IMAGE" SRC = "../icons/small/arrow-up.jpg" NAME="U"
VALUE="U">
```

```
<INPUT TPYE="IMAGE" SRC = "../icons/small/arrow-down.jpg" NAME="D"
VALUE="D">
</FORM>
```

PMP **400** then determines if the user wants to navigate the image (**422**). If the user wants to navigate the image, then PMP **400** runs PNP **500** on the HHDD (**424**). PNP **400** then sends the requested fragment to the HHDD (**426**) and returns to step **422**. If at step **422** the user does not want to navigate the image, PMP **400** ends (**424**).

Turning to FIG. 8, the logic of Proxy Navigation Program (PNP) **500** is illustrated. PNP **500** is a program that navigates the image fragmented by IMP **200**. PNP **500** starts (**502**) when prompted by PMP **400**. PNP **500** then makes a determination whether the user has pressed an up button (**504**). If the user has pressed the up button, PNP **500** requests the fragment directly above the present fragment (**506**) and proceeds to step **508**. If the user has not pressed the up button, then PNP **500** proceeds to step **508** where PNP **500** makes a determination whether the user has pressed the down button (**508**). If the user has pressed the down button, PNP **500** requests the fragment directly below the present fragment (**510**) and proceeds to step **512**. If the user has not pressed the down button, then PNP **500** proceeds to step **512** where PNP **500** makes a determination whether the user has pressed the left button (**512**). If the user has pressed the left button, PNP **500** requests the fragment directly to the left of the present fragment (**514**) and proceeds to step **516**. If the user has not pressed the left button, then PNP **500** proceeds to step **516** where PNP **500** makes a determination whether the user has pressed the right button (**516**). If the user has pressed the right button, PNP **500** requests the fragment directly to the right of the present fragment (**518**) and ends (**520**). If the user has not pressed the right button, then PNP **500** ends (**520**).

Turning to FIG. 9, an image from a web page is illustrated. The illustrated image is characteristic of the type of image that a HHDD user would want to access. The illustration contains a large amount of information displayed in great detail. When an image, such as the illustration in FIG. 9, is reduced to fit onto the smaller screen of a HHDD, much of the information on the image will be too small to be of any use to the user. Therefore, the present invention fragments the image using IMP **200** or PMP **400**, as illustrated in FIG. 10. One of the numbered fragments may then be displayed on the HHDD such that the user can view a portion of the original image, but is able to discern all of the information that is readily discernable from the image because the image is displayed at the intended resolution. FIG. 11 is an illustration of a HHDD running a web browser utilizing the present invention. As can be seen in FIG. 11, the web browser displays the reduced web page, but the reduced image has been replaced by the fifth (center) image fragment so that the user may view the image at the intended resolution.

While the preferred embodiment of the present invention is directed at browsing the Internet using a HHDD, the preferred embodiment is not meant as a limitation of the present invention. For example, certain aspects of the present invention may be applicable to digital camera displays, particularly in higher resolution digital cameras. The liquid crystal display (LCD) screen of a digital camera can use the present invention to show the full size digital picture at the same resolution the digital picture will be printed. The present invention may also be applicable to full size display screen as well. Other applications of the novel and non-obvious aspects presented herein will be appreciated by a person of ordinary skill in the art.

With respect to the above description, it is to be realized that the optimum dimensional relationships for the parts of the invention, to include variations in size, materials, shape, form, function and manner of operation, assembly and use, are deemed readily apparent and obvious to

one skilled in the art, and all equivalent relationships to those illustrated in the drawings and described in the specification are intended to be encompassed by the present invention. The novel spirit of the present invention is still embodied by reordering or deleting some of the steps contained in this disclosure. The spirit of the invention is not meant to be limited in any way except by proper construction of the following claims.